

**WHAT IS CLAIMED IS:**

1                   1.     An integrated air duct for an aircraft engine with multiple propulsion  
2 systems, said integrated air duct comprising:  
3                   a fixed outer wall with an opening for incoming air,  
4                   a fixed inner wall dividing said duct into a first channel having a leading rim  
5 downstream of said opening and a second channel between said fixed inner wall and  
6 said fixed outer wall,  
7                   a movable panel mounted within said fixed outer wall at a pivot axis upstream  
8 of said leading rim of said first channel for pivoting between an open position  
9 allowing incoming air entering through said opening to enter said first and second  
10 channels simultaneously and a closed position obstructing air entry into said second  
11 channel and thereby causing substantially all incoming air entering through said  
12 opening to enter said first channel, and  
13                   means for moving said movable panel between said open position and said  
14 closed position.

1                   2.     The integrated air duct of claim 1 wherein said movable panel when in  
2 said closed position extends from said pivot axis to said leading rim of said first channel.

1                   3.     The integrated air duct of claim 1 wherein said movable panel when in  
2 said closed position forms a converging flow passage from said pivot axis to said leading rim  
3 of said first channel.

1                   4.     The integrated air duct of claim 1 wherein said movable panel when in  
2 said closed position forms a converging flow passage from said pivot axis to said leading rim  
3 of said first channel, and when in said open position forms a diverging passage from said  
4 pivot axis to said fixed outer wall.

1                   5.     The integrated air duct of claim 1 wherein said opening and said first  
2 channel each have transverse cross sections that are substantially circular.

1                   6.     The integrated air duct of claim 5 wherein said second channel fully  
2 encircles said first channel.

1                   7.     The integrated air duct of claim 5 wherein said first channel is  
2 substantially coaxial with said opening.

1                   8.     The integrated air duct of claim 5 wherein said first channel is axially  
2 offset relative to said second channel.

1                   9.     The integrated air duct of claim 5 comprising a plurality of said  
2 movable panels distributed along the circumference of said first channel.

1                   10.    The integrated air duct of claim 5 comprising a plurality of said  
2 movable panels distributed along the circumference of said first channels, said movable  
3 panels alternating with an equal number of struts joining said fixed inner wall to said fixed  
4 outer wall, each said strut having a fuel injector mounted thereto.

1                   11.    The integrated air duct of claim 1 wherein said movable panel is  
2 defined as a flow-diverting panel and said integrated air duct further comprises an additional  
3 movable panel defined as a diffuser panel, mounted within said fixed outer wall downstream  
4 of said flow diverting panel, said flow-diverting and diffuser panels each having a pivotally  
5 mounted end and a free end, said flow-diverting and diffuser panels meeting at said free ends.

1                   12.    The integrated air duct of claim 1 wherein said movable panel is  
2 defined as a flow-diverting panel and said integrated air duct further comprises a downstream  
3 movable panel mounted to said fixed outer wall downstream of said flow diverting panel,  
4 said flow-diverting and downstream panels when open providing a through-passage through  
5 said second channel and when closed forming an enclosed chamber in said second channel.

1                   13.    The integrated air duct of claim 1 in which said movable panel is one  
2 of a first plurality of movable panels each mounted within said fixed outer wall at a pivot axis  
3 upstream of said leading rim of said first channel for pivoting between an open position  
4 allowing incoming air to enter both said first and second channels and a closed position  
5 obstructing air entry into said second channel and thereby causing substantially all incoming  
6 air to enter said first channel, said integrated air duct further comprising a second plurality of  
7 movable panels mounted to said fixed outer wall downstream of said first plurality, each of  
8 said first and second pluralities of movable panels when open providing a through-passage

9 through said second channel and when closed forming an enclosed chamber in said second  
10 channel.

1           14.    The integrated air duct of claim 1 in which said movable panel is one  
2 of a first plurality of movable panels each mounted within said fixed outer wall at a pivot axis  
3 upstream of said leading rim of said first channel for pivoting between an open position  
4 allowing incoming air to enter both said first and second channels and a closed position  
5 obstructing air entry into said second channel and thereby causing substantially all incoming  
6 air to enter said first channel, said integrated air duct further comprising a second plurality of  
7 movable panels mounted to said fixed outer wall downstream of said first plurality, said first  
8 and second pluralities of movable panels arranged to be movable to a position providing said  
9 second channel with a convergent/divergent profile to decelerate incoming supersonic flow  
10 first to substantially sonic flow and then to subsonic flow.

1           15.    The integrated air duct of claim 1 wherein said means for moving said  
2 movable panel is an electromagnetic actuator.

1           16.    An aircraft engine having multiple propulsion systems, said aircraft  
2 engine comprising:  
3           a ramjet,  
4           a booster propulsion system, and  
5           an integrated air duct comprising:  
6               a fixed outer wall with an opening for incoming air,  
7               a fixed inner wall dividing said duct into (i) a first channel extending  
8               from a leading rim downstream of said opening to said ramjet  
9               and (ii) a second channel between said fixed inner wall and said  
10              fixed outer wall leading to said booster propulsion system,  
11              a movable panel mounted within said fixed outer wall at a pivot axis  
12              upstream of said leading rim of said first channel for pivoting  
13              between an open position allowing incoming air entering  
14              through said opening to enter said first and second channels  
15              simultaneously and a closed position obstructing air entry into  
16              said second channel and thereby causing substantially all  
17              incoming air entering through said opening to enter said first  
18              channel, and

19 means for moving said movable panel between said open position and  
20 said closed position.

1 17. The aircraft engine of claim 16 wherein said booster propulsion system  
2 is a turbojet.

1 18. The aircraft engine of claim 16 wherein said booster propulsion system  
2 is a rocket motor.

1 19. The aircraft engine of claim 16 wherein said booster propulsion system  
2 is a combination turbojet and rocket motor.

1 20. The aircraft engine of claim 16 wherein said ramjet is a scramjet and  
2 said engine further comprises rocket motors positioned within said first channel to  
3 supplement said scramjet.

1 21. The aircraft engine of claim 16 wherein said first channel is of  
2 substantially circular cross section and said movable panel is one of a plurality of movable  
3 panels mounted within said fixed outer wall at a pivot axis upstream of said leading rim of  
4 said first channel for pivoting between an open position allowing incoming air entering  
5 through said opening to enter both said first and second channels and a closed position  
6 causing substantially all incoming air entering through said opening to enter said first  
7 channel, said movable panels when in said closed position forming a converging flow  
8 passage toward said first channel.

1 22. The aircraft engine of claim 21 wherein said first channel is of  
2 substantially circular transverse cross section and said second channel fully encircles said  
3 first channel, said movable panels distributed around said first channel.

1 23. The aircraft engine of claim 21 wherein said first channel is of  
2 substantially circular transverse cross section and is axially offset relative to said second  
3 channel.